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AFOSR Space Propulsion and Power Nano-energetics Program

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AFOSR and NASA Launch First-Ever Test Rocket Fueled by green, Safe Aluminum-Ice Propellant



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Nanoenergetic Materials



Enabler for “New Ways to Store & Release Chemical Energy” Basic Research Strategy

- **Future Propellants & Explosives**
- **Increased Energy Storage**
- **Managed Energy Release**
- **Increased Lethality & Range**
- **Reduced Sensitivity**
- **New Propulsion and Weapons Concepts**
- **Increased Storage Lifetime**
- **Green Energetics**
- **Reduced Environmental Impact**

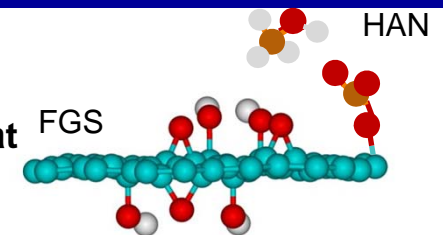


Space Propulsion and Power

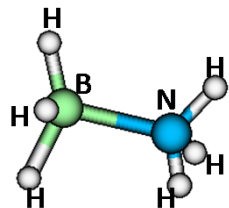
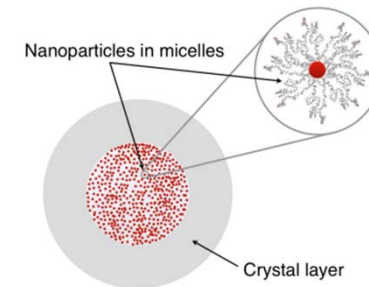
Examples of Accomplishments



- (2010) observed electrolytic decomposition of ionic monopropellant in microchannel by adding dispersed nano-catalyst (.1% weight graphene sheets) that will eliminate structural catalyst

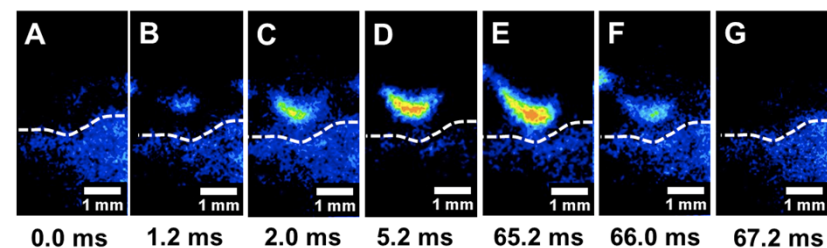


- (2010) First Ever Nano-Aluminum Encapsulated with Ammonium Perchlorate and RDX



- Ammonia Borane added to hybrid fuel (paraffin), $I_{sp,exp}$ increased ~10% with 20% mass addition

- High speed OH PLIF reveals that coarse ammonium perchlorate burns much faster at high pressures





FY 2012 AFOSR MURI on Smart Functional Nanoenergetics Design from the Atomistic/Molecular Scale through the Mesoscale



Objectives:

- ***Create the scientific foundation for the understanding of smart and functional nanoenergetics that are designed from the atomistic/molecular scale through the mesoscale***

“Smart nanoenergetics may be activated by temperature, pressure, the presence of a particular chemical compound, or external electromagnetic stimuli, such as an electrical field or light”

- ***initiate a reaction at a particular temperature***
 - ***to release a particular compound at a particular temperature***
 - ***Control transition from a deflagration to a detonation at a particular instant in time***
 - ***to turn on or turn off a reaction***
 - ***have tailored ignition properties***
 - ***to accelerate or slow a reaction with time or location***
 - ***characterize structural, chemical composition, mechanical, stability, compatibility, aging, sensitivity, reactivity***
-
- ***Provide the scientific pathways to generate micron size reactive materials with nanostructured features***